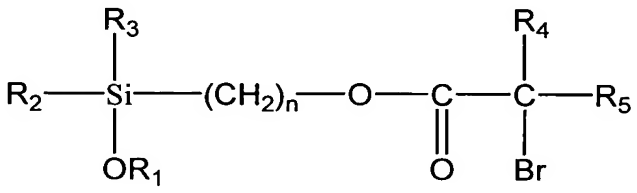
CLAIMS

1. A process for growing a polyethylene glycol alkyl acrylate (PEGAA) film on a substrate having a moiety accepting surface comprising

(a) contacting at least one initiator molecule with the moiety accepting surface of the substrate to form an initiator coated substrate, said initiator molecule being selected from the group consisting of

i)



wherein:

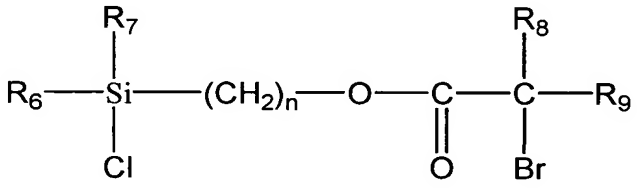
n is an integer of 1 to 50;

R_1 and R_4 are each independently a CH_3, C_2H_5, or an alkyl of 3 to 20 carbons;

R_2 and R_3 are each independently a CH_3, C_2H_5, OR_1, or an alkyl of 3 to 20 carbons; and

R_5 is a H, CH_3, C_2H_5, or an alkyl of 3 to 20 carbons,

ii)



wherein:

n is an integer of 1 to 50;

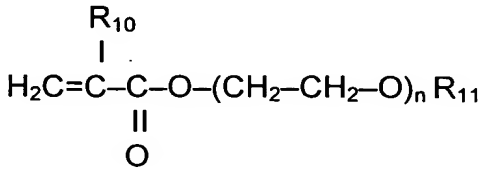
R_6 and R_7 are each independently Cl, CH_3, C_2H_5, or an alkyl of 3 to 20 carbons;

R_8 is a CH_3, C_2H_5, or an alkyl of 3 to 20 carbons; and

R_9 is a H, CH_3, C_2H_5, or an alkyl of 3 to 20 carbons, and

iii) mixtures thereof; and

(b) further contacting the initiator coated substrate with at least one polyethylene glycol alkyl acrylate monomer in solution, wherein said polyethylene glycol alkyl acrylate monomer has the general formula



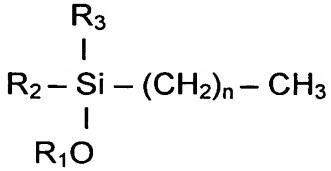
wherein:

n is an integer of 1 to 100; and

R_{10} and R_{11} are each independently H, CH3, C_2H_5, or an alkyl of 1 to 20 carbons, further wherein at least one catalyst and optionally at least one ligand are added to the solution containing the polyethylene glycol alkyl acrylate monomer.

2. The process according to claim 1, wherein the moiety accepting surface of the substrate is further contacted in step (a) with at least one spacer molecule, wherein said spacer molecule comprises at least one of

(i) alkyl chains having the following general formulas

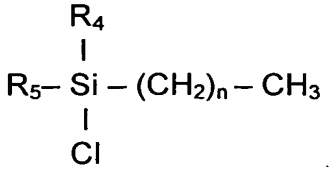


wherein:

n is an integer of 1 to 50;

R_1 is a CH_3, C_2H_5, or an alkyl of 3 to 20 carbons;

R_2 and R_3 are each independently a CH_3, C_2H_5, OR_1, or an alkyl of 3 to 20 carbons; and

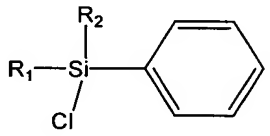


wherein:

n is an integer of 1 to 50;

R_4 and R_5 are each independently Cl, CH_3, C_2H_5, or an alkyl of 3 to 20 carbons;

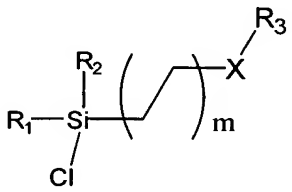
(ii) phenyl and phenyl derivatives having the following general formula



wherein:

R_1 and R_2 are each independently Cl, CH_3, C_2H_5, or an alkyl of 3 to 20 carbons; or

(iii) a mixture of alkyl chains and functional groups having the following general formula



wherein:

m is an integer of 1 to 50;

R_1 and R_2 are each independently Cl, CH_3, C_2H_5, or an alkyl of 3 to 20 carbons;

R3 is a phenyl, OH, NH_2, or an alkyl of 3 to 20 carbons; and

X is an O, COO, or a CONH.

3. The process according to claim 2, wherein the spacer molecule is n-propyl triethoxysilane.

4. The process according to claim 2, wherein the initiator to spacer molecule ratio ranges from about 95:5 mol % to 1:99 mol %.

5. The process according to claim 1 or 2, wherein the initiator molecule is 5'-(triethoxylsilylpentyl) 2-bromo-2-methylpropionate.

6. The process according to claim 1 or 2, wherein the polyethylene glycol alkyl acrylate monomer is polyethylene glycol methacrylate.

7. The process according to claim 1 or 2, wherein the substrate is selected from the group consisting of glass, metal oxide, silicon, fabric, quartz, zirconia and polymeric resins.

8. The process according to claim 1, wherein the polyethylene glycol alkyl acrylate film grown on the surface of the substrate has a thickness ranging from about 0.5 nm to about 5000 nm.

9. The process according to claim 1, wherein the polyethylene glycol alkyl acrylate film grown on the surface of the substrate has a density of polyethylene glycol alkyl acrylate polymer chains ranging from about 0.1% to about 100%.

10. The process according to claim 1 further comprising baking the substrate after said substrate is coated with the at least one initiator molecule, wherein said substrate is baked in an oven at a temperature ranging from 100° C to 180° C for a time period ranging from 30 minutes to 10 hours.

11. The process according to claim 1, wherein a polar solvent is added to the solution containing the polyethylene glycol alkyl acrylate monomer.

12. The process according to claim 11, wherein the polar solvent is water.

13. The process according to claim 1 or 2, wherein step (a) is performed in the presence of a solvent.

14. The process according to claim 13, wherein said solvent is selected from the group consisting of water, hydrocarbons, ethers, halogenated hydrocarbons, ketones, methyl ethyl ketones, methyl isobutyl ketones, alcohols, nitriles, esters, carbonates, inorganic solvents, and mixtures thereof.

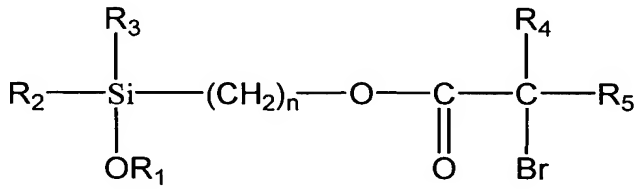
15. The process according to claim 1 or 2, wherein the ligand is selected from the group consisting of 2,2'-bipyridyl, 1,10-phenanthroline, an alkylamine, a polyamine, and a trialkoxyaluminum.

16. The process according to claim 1 or 2, wherein the catalyst is selected from the group consisting of cuprous chloride, cupric chloride, cuprous bromide, cuprous iodide, cuprous cyanide, cuprous oxide, cuprous acetate, cuprous perchlorate, a tristriphenylphosphine complex of divalent ruthenium ($RuCl_2(PPh_3)_3$), and tristriphenylphosphine complex of divalent iron ($FeCl_2(PPh_3)_3$).

17. A biologically resistant device having deposited thereon a polymeric composition comprising

(a) at least one initiator molecule selected from the group consisting of

i)



wherein:

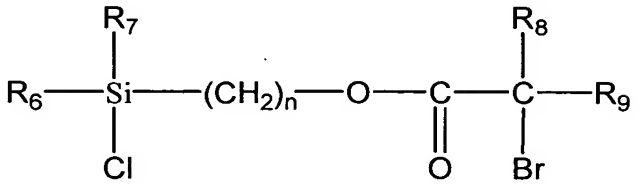
n is an integer of 1 to 50;

R_1 and R_4 are each independently a CH_3, C_2H_5, or an alkyl of 3 to 20 carbons;

R_2 and R_3 are each independently a CH_3, C_2H_5, OR_1, or an alkyl of 3 to 20 carbons; and

R_5 is a H, CH_3, C_2H_5, or an alkyl of 3 to 20 carbons,

ii)



wherein:

n is an integer of 1 to 50;

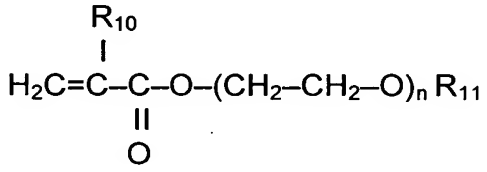
R_6 and R_7 are each independently Cl, CH_3, C_2H_5, or an alkyl of 3 to 20 carbons;

R_8 is a CH_3, C_2H_5, or an alkyl of 3 to 20 carbons; and

R_9 is a H, CH_3, C_2H_5, or an alkyl of 3 to 20 carbons, and

iii) mixtures thereof; and

(b) at least one polyethylene glycol alkyl acrylate monomer having the general formula



wherein:

n is an integer of 1 to 100; and

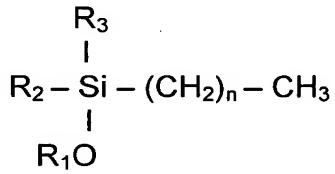
R_{10} and R_{11} are each independently H, CH3, C_2H_5, or an alkyl of 1 to 20 carbons.

18. The device of claim 17, wherein the initiator molecule of the polymeric composition is 5'-(triethoxylsilylpentyl) 2-bromo-2-methylpropionate.

19. The device according to claim 17, wherein the polyethylene glycol alkyl acrylate monomer of the polymeric composition is polyethylene glycol methacrylate.

20. The device according to claim 17, wherein the polymeric composition optionally further comprises a spacer molecule comprising at least one of

(i) alkyl chains having the following general formulas

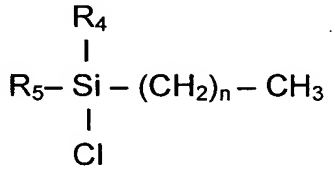


wherein:

n is an integer of 1 to 50;

R_1 is a CH_3, C_2H_5, or an alkyl of 3 to 20 carbons;

R_2 and R_3 are each independently a CH_3, C_2H_5, OR_1, or an alkyl of 3 to 20 carbons; and

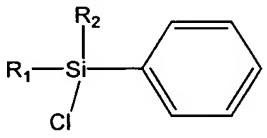


wherein:

n is an integer of 1 to 50;

R_4 and R_5 are each independently Cl, CH_3, C_2H_5, or an alkyl of 3 to 20 carbons;

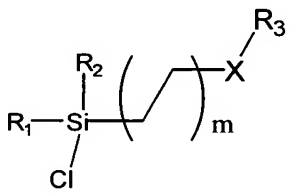
(ii) phenyl and phenyl derivatives having the following general formula



wherein:

R_1 and R_2 are each independently Cl, CH_3, C_2H_5, or an alkyl of 3 to 20 carbons; or

(iii) a mixture of alkyl chains and functional groups having the following general formula



wherein:

m is an integer of 1 to 50;

R_1 and R_2 are each independently Cl, CH_3, C_2H_5, or an alkyl of 3 to 20 carbons;

R3 is a phenyl, OH, NH2, or an alkyl of 3 to 20 carbons; and

X is an O, COO, or a CONH.

21. The device according to claim 20, wherein the spacer molecule of the polymeric composition is n-propyl triethoxysilane.

22. The device according to claim 20, wherein the polymeric composition has an initiator to spacer molecule ratio ranging from about 1:99 to about 99:1.

23. A substrate coated according to the process of claim 1 or 2.

24. The substrate of claim 23, wherein said substrate is selected from the group consisting of glass, metal oxide, silicon, fabrics, porous substrates, quartz, polymeric substrates reinforced with other inorganic materials, zirconia and polymeric resins.

25. The substrate of claim 23, wherein the moiety accepting surface of the substrate has a polyethylene glycol alkyl acrylate chain density ranging from about 0.1% to about 100%.

26. The device of claim 17, comprising a biomedical implant device, biomedical microdevice, membrane-related appliance, prosthetic device, orthopedic implantable device, biosensor, enzyme-linked immunosorbent assay (ELISA) substrate, medical device, patterned cell culture system, tissue engineered material, microfluidic and analytical system material, drug delivery device, high throughput screening system, food packaging material, hygienic product, or electronic material.

27. The device of claim 20, comprising a biomedical implant device, biomedical microdevice, membrane-related appliance, prosthetic device, orthopedic implantable device, biosensor, enzyme-linked immunosorbent assay (ELISA) substrate, medical device, patterned cell culture system, tissue engineered material, microfluidic and analytical system material, drug delivery device, high throughput screening system, food packaging material, hygienic product, or electronic material.

28. A process for growing a polyethylene glycol methacrylate film on a substrate having a hydroxylated surface comprising
    (a) contacting 5'-(triethoxylsilylpentyl) 2-bromo-2-methylpropionate mixed optionally with n-propyl triethoxysilane with the hydroxylated surface of the substrate in the presence of toluene; and then
    (b) further contacting the surface of the substrate with polyethylene glycol methacrylate in an aqueous solution containing bipyridyl, cuprous chloride and cupric chloride.

29. The process of claim 28, wherein said substrate comprises a biomedical implant device, biomedical microdevice, membrane-related appliance, prosthetic device, orthopedic implantable device,

biosensor, enzyme-linked immunosorbent assay (ELISA) substrate, medical device, patterned cell culture system, tissue engineered material, microfluidic and analytical system material, drug delivery device, high throughput screening system, food packaging material, hygienic product, or electronic material.